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Paedomorphosis and neurocranial ossification in two Devonian lungfishes

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Lungfishes are one of the few early vertebrate clades with a rich 410-million-years-old fossil record. Lungfishes are characterized by a low evolutionary rate assumed to be associated with paedomorphosis since the Late Devonian. Lungfish paedomorphic trends include a reduction of the number of median fins, reduction of the number of cranial dermal bones, and reduction of the degree of neurocranial ossification. This neurocranial trait has evolved from heavily ossified in Devonian species to completely cartilaginous in post-Devonian species. Neurocranial conditions among derived Devonian lungfishes are needed to have a better understanding of paedomorphosis as a driving force during lungfish evolution. The neurocrania of two Devonian species, *Scaumenacia curta* (middle Frasnian, Escuminac Formation, eastern Canada) and *Pentlandia macroptera* (Givetian, Orcadian Basin, Scotland), have been micro-CT-scanned. These species were assumed to have a cartilaginous neurocranium like other "phaneropleurids" and "fleurantids". Juvenile (or sub-adult) and adult specimens of *S. curta* possess cartilaginous neurocrania, whereas *P. macroptera* is now recognized to have a poorly ossified neurocranium. Pyrite filled neurocranial cavities preserving some endocranial structures (e.g., olfactory bulbs, semicircular canals) allow us to code for phylogenetic endocranial characters in *S. curta* . This unique mode of preservation suggests that occasionally pyrite is a preservative rather than a destructive diagenetic agent. In the evolutionary gap between *Pentlandia* and *Scaumenacia*, paedomorphosis had already resulted in reduction of neurocranial ossification while little changes occurred in cranial dermal bones.

Key words: Dipnoi, heterochrony, ontogeny, phylogeny, pyritization, Escuminac Formation, Orcadian Basin.

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